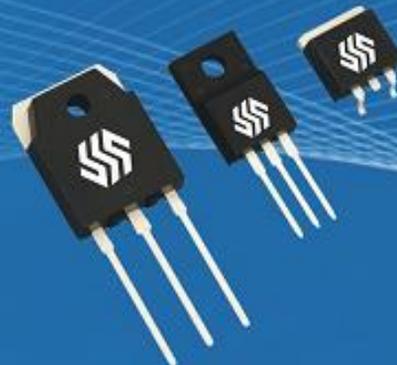




SUPER-SEMI



SUPER-MOSFET

Super Junction Metal Oxide Semiconductor Field Effect Transistor

600V Super Junction Power MOSFET Gen-II With Fast-Recovery
SS*60R043SFD2

Rev. 1.1
Sep. 2022

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SUPER

SSW60R043SFD2 600V N-Channel Super-Junction MOSFET Gen-II With Fast-Recovery

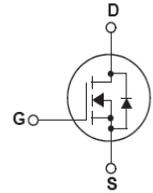
Description

SJ-FET is new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance. This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. SJ-FET is suitable for various AC/DC power conversion in switching mode operation for higher efficiency.

Features

- Multi-Epi process SJ-FET
- Fast-Recovery body diode
- Extremely Low Reverse Recovery Charge
- 650V @T_J = 150 °C
- Typ. R_{DS(on)} = 36mΩ
- Ultra Low Gate Charge (typ. Q_g = 140nC)
- 100% avalanche tested

SSW60R043SFD2



Absolute Maximum Ratings

Symbol	Parameter	SSW60R043SFD2	Unit
V _{DSS}	Drain-Source Voltage	600	V
I _D	Drain Current -Continuous (TC = 25°C) -Continuous (TC = 100°C)	64* 40.5*	A
I _{DM}	Drain Current - Pulsed (Note 1)	192	A
V _{GSS}	Gate-Source voltage	±30	V
E _{AS}	Single Pulsed Avalanche Energy (Note 2)	1200	mJ
I _{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by T _J max)	9	A
dv/dt	Peak Diode Recovery dv/dt (Note 3)	15	V/ns
dVds/dt	Drain Source voltage slope (V _{ds} =480V)	50	V/ns
P _D	Power Dissipation (TC = 25°C)	330	W
T _J , T _{STG}	Operating and Storage Temperature Range	-55 to +150	°C
T _L	Maximum Lead Temperature for Soldering Purpose, 1/16" from Case for 10 Seconds	260	°C

* Drain current limited by maximum junction temperature. Maximum duty cycle D=0.75.

Thermal Characteristics

Symbol	Parameter	SSW60R043SFD2	Unit
R _{θJC}	Thermal Resistance, Junction-to-Case	0.38	°C/W
R _{θCS}	Thermal Resistance, Case-to-Sink Typ.	0.5	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient	62	°C/W

SSW60R043SFD2 600V N-Channel Super-Junction MOSFET Gen-II With Fast-Recovery



Electrical Characteristics TC = 25°C unless otherwise noted

SSW60R043SFD2 600V N-Channel Super-Junction MOSFET Gen-II With Fast-Recovery

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 1mA, T _J = 25°C	600	-	-	V
		V _{GS} = 0V, I _D = 1.5mA, T _J = 150°C	650	-	-	V
ΔBV _{DSS} /ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 1.5mA, Referenced to 25°C	-	0.6	-	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 600V, V _{GS} = 0V -T _J = 125°C	-	1 200	5 -	μA μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30V, V _{DS} = 0V	-	-	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30V, V _{DS} = 0V	-	-	-100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 4mA	3.0	4.0	5.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10V, I _D = 32A	-	36	43	mΩ
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 100V, V _{GS} = 0V, f = 1.0MHz	-	5600	-	pF
C _{oss}	Output Capacitance		-	230	-	pF
C _{rss}	Reverse Transfer Capacitance		-	1.2	-	pF
Q _g	Total Gate Charge	V _{DS} = 400V, I _D = 32A, V _{GS} = 10V (Note 4)	-	140	-	nC
Q _{gs}	Gate-Source Charge		-	42	-	nC
Q _{gd}	Gate-Drain Charge		-	59	-	nC
V _{plateau}	Gate plateau voltage		-	6.5	-	V
R _g	Gate resistance	f=1 MHz, open drain	-	1	-	Ω
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DS} = 400V, I _D = 32A R _G = 3.3Ω, V _{GS} = 10V (Note 4)	-	30	-	ns
t _r	Turn-On Rise Time		-	13	-	ns
t _{d(off)}	Turn-Off Delay Time		-	96	-	ns
t _f	Turn-Off Fall Time		-	10	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		-	-	64	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		-	-	192	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0V, I _S = 32A	-	0.9	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, V _{DS} = 400V, I _S = 32A, dI _F /dt = 100A/μs	-	195	-	ns
Q _{rr}	Reverse Recovery Charge		-	1.9	-	μC
I _{rrm}	Peak Reverse Recovery Current		-	20	-	A

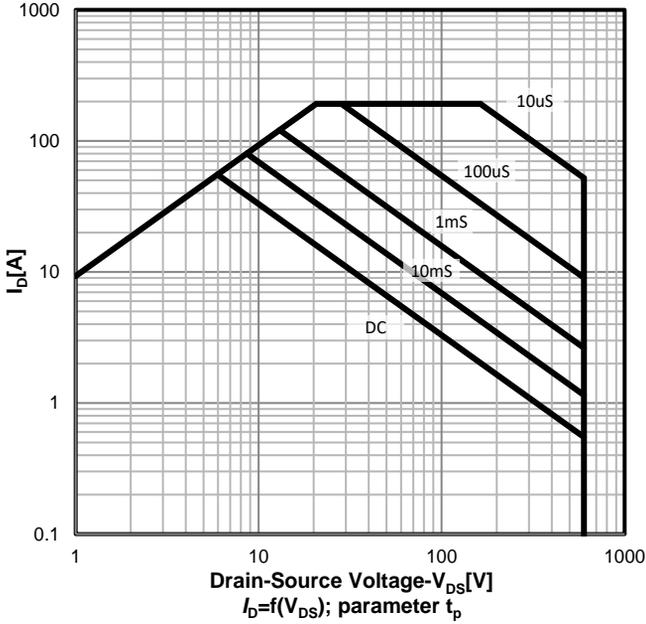
NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_D=I_{AS}, V_{DD}=100V, L=30mH, Starting T_J=25 °C
3. I_{SD}≤I_D, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25 °C
4. Essentially Independent of Operating Temperature Typical Characteristics

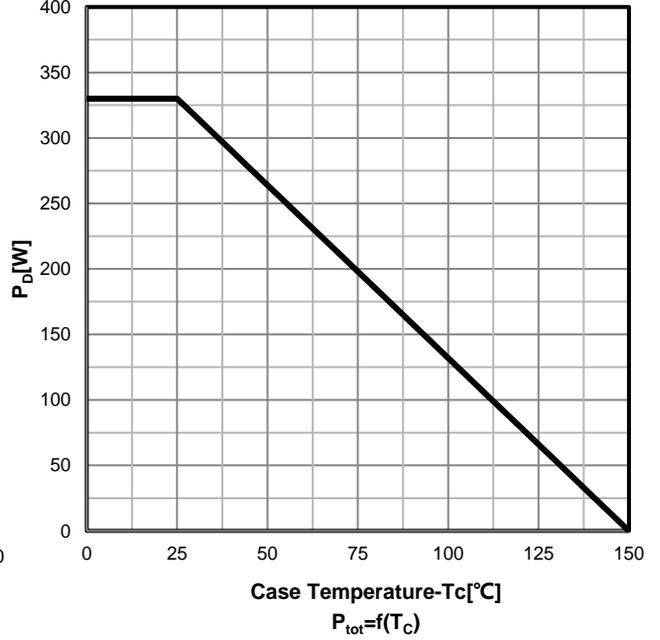


Typical Performance Characteristics

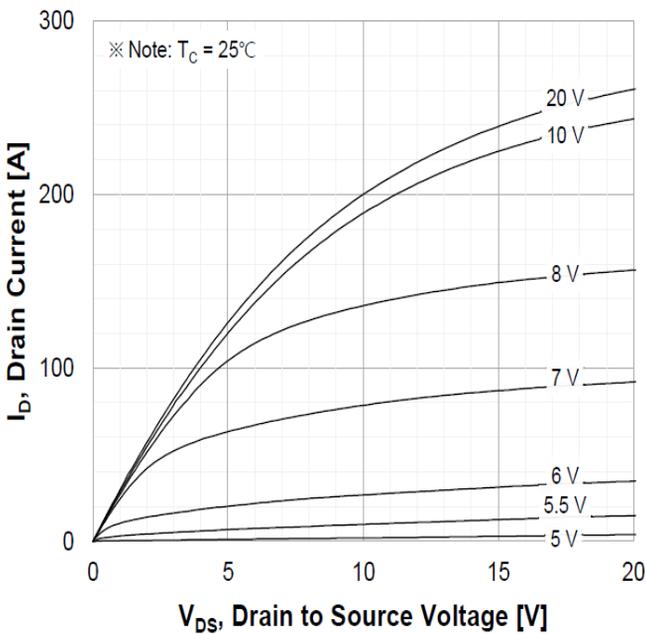
Safe operating area TC=25 °C
TO-247



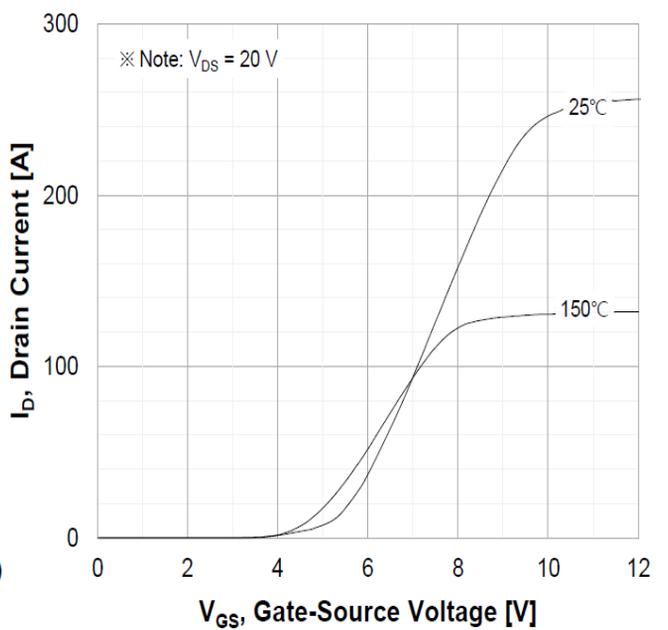
Power dissipation



Typ. output characteristics $T_J=25\text{ }^\circ\text{C}$



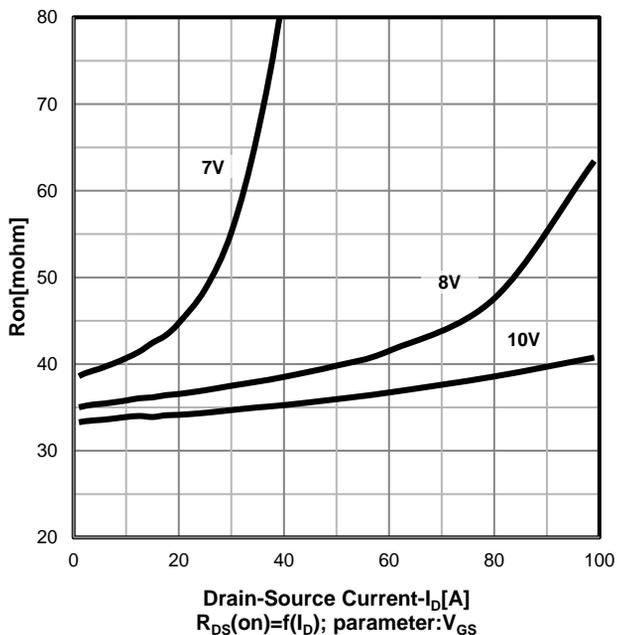
Transfer characteristics



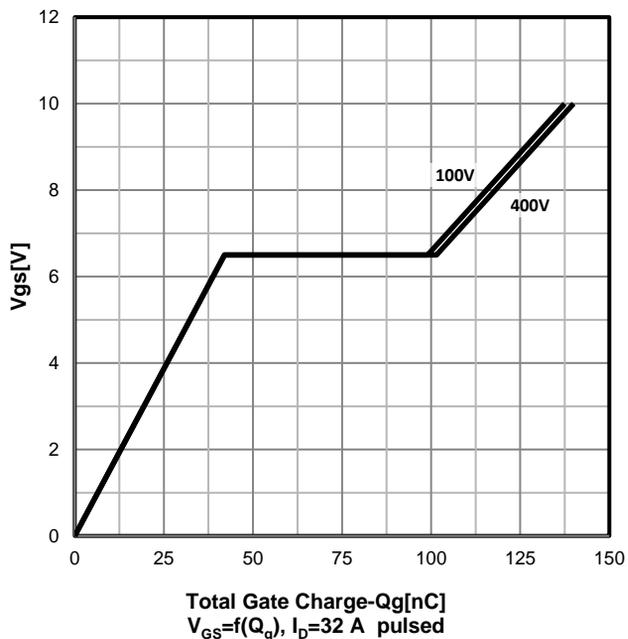


Typical Performance Characteristics

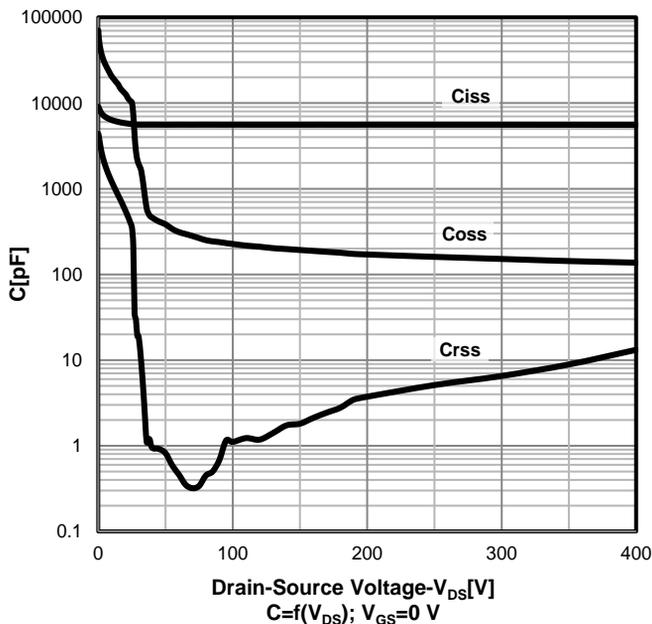
Typ. drain-source on-state resistance



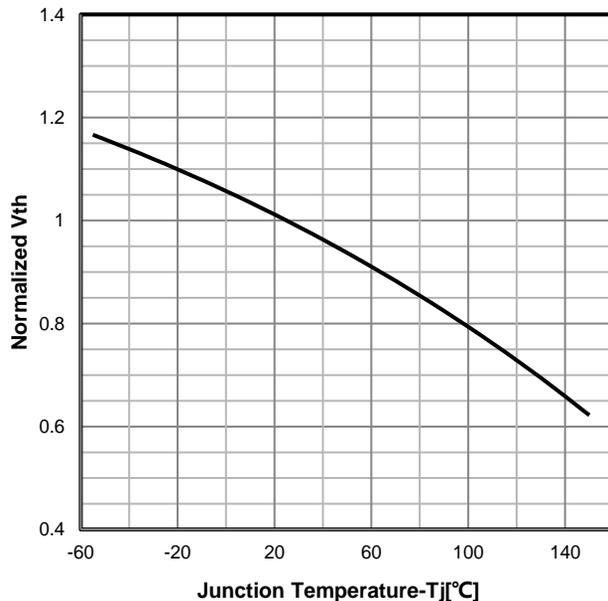
Typ. gate charge characteristics



Typ. capacitances



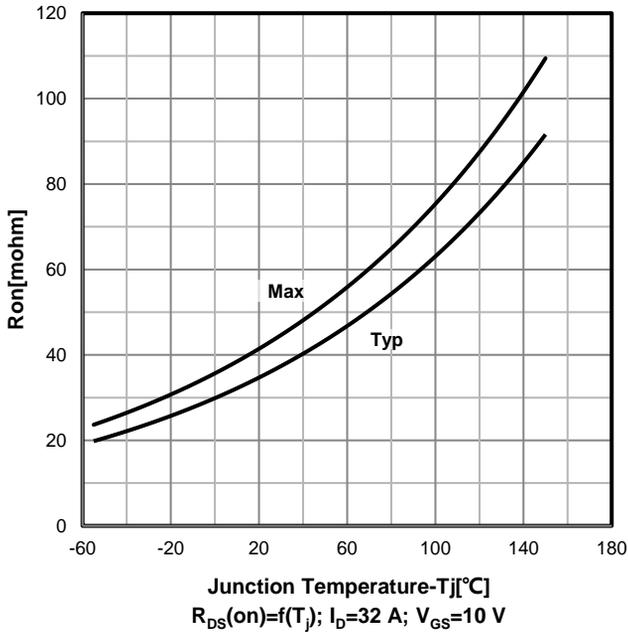
Normalized $V_{GS(th)}$ characteristics



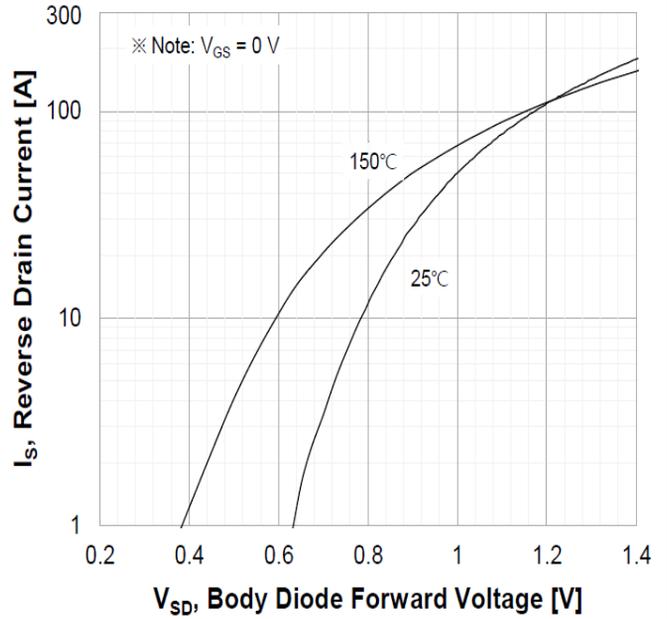


Typical Performance Characteristics

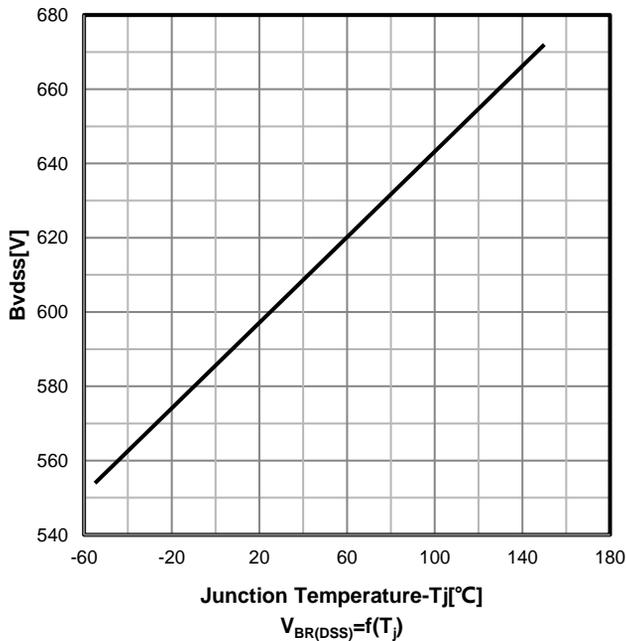
On-resistance vs temperature



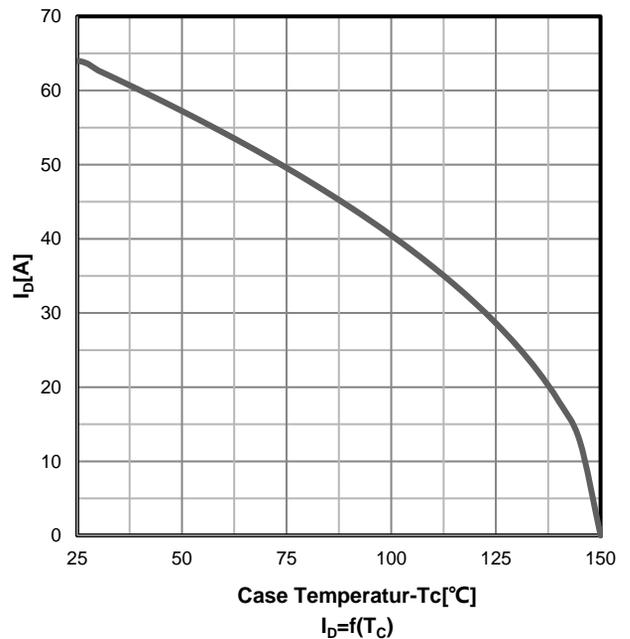
Forward characteristics of reverse diode



Drain-source breakdown voltage



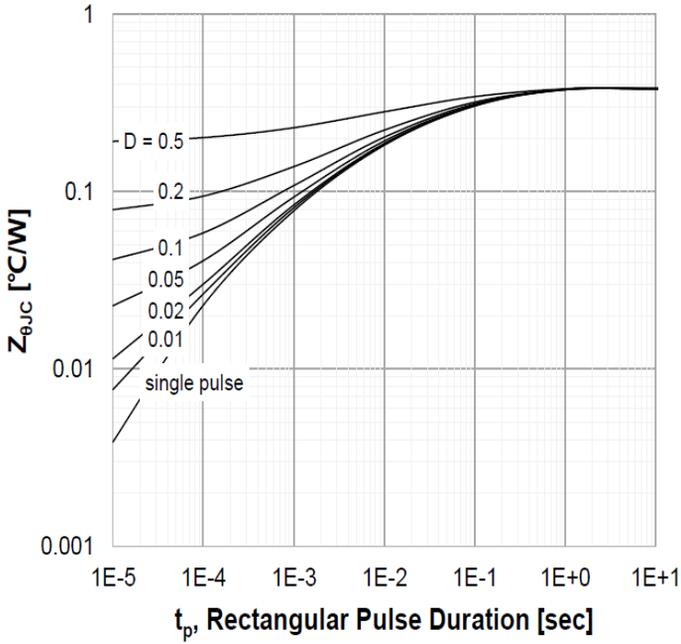
Drain current vs temperature



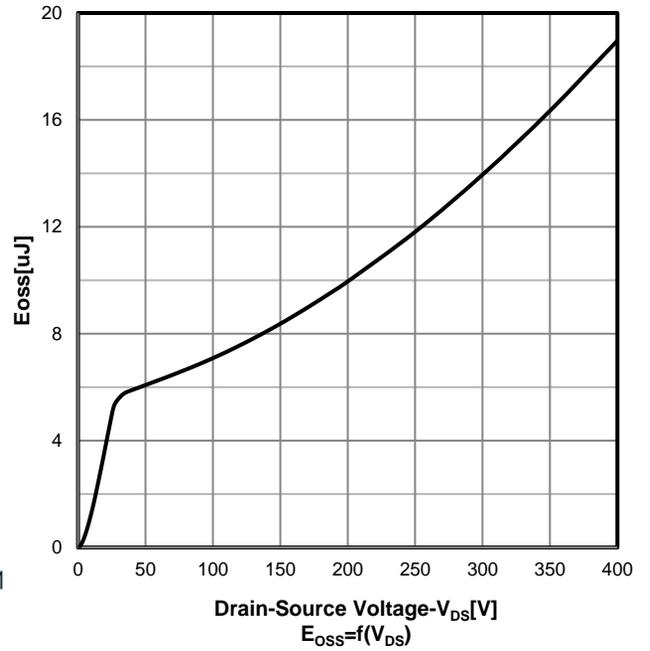


Typical Performance Characteristics

Max. transient thermal impedance
parameter: $D=tp/T$

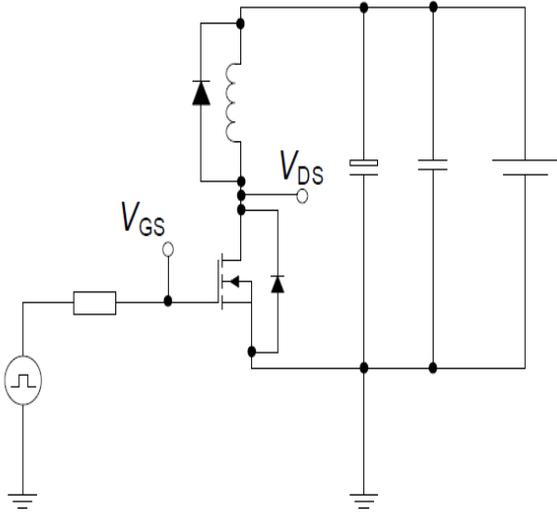


Coss stored energy

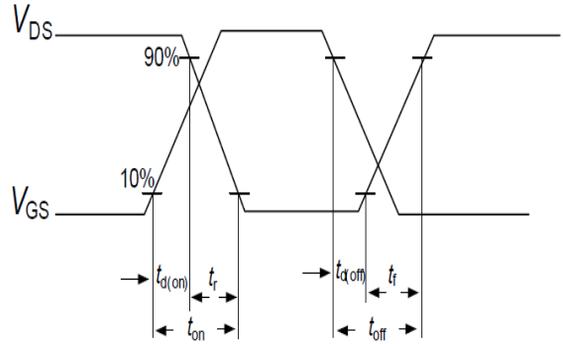


Switching times test circuit and waveform for inductive load

Switching times test circuit for inductive load

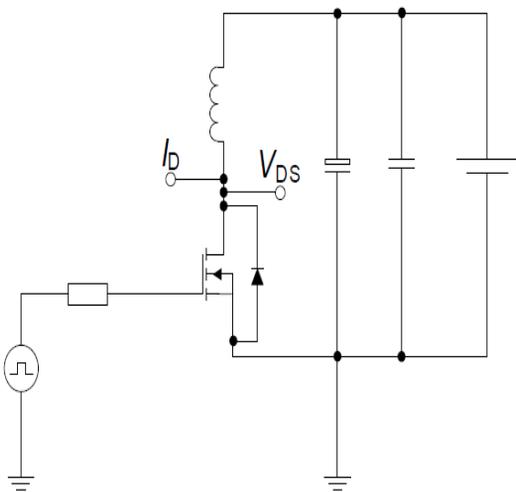


Switching time waveform

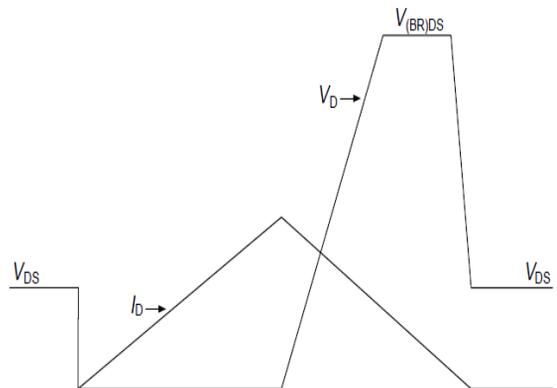


Unclamped inductive load test circuit and waveform

Unclamped inductive load test circuit

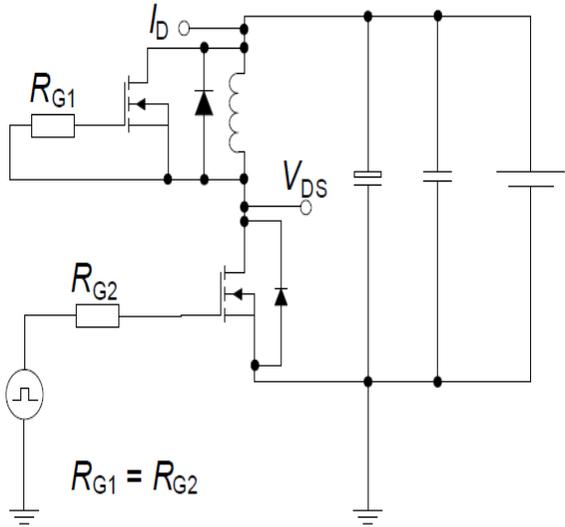


Unclamped inductive waveform

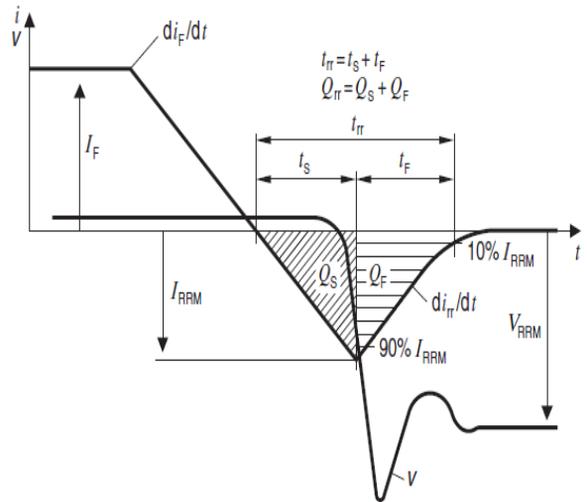


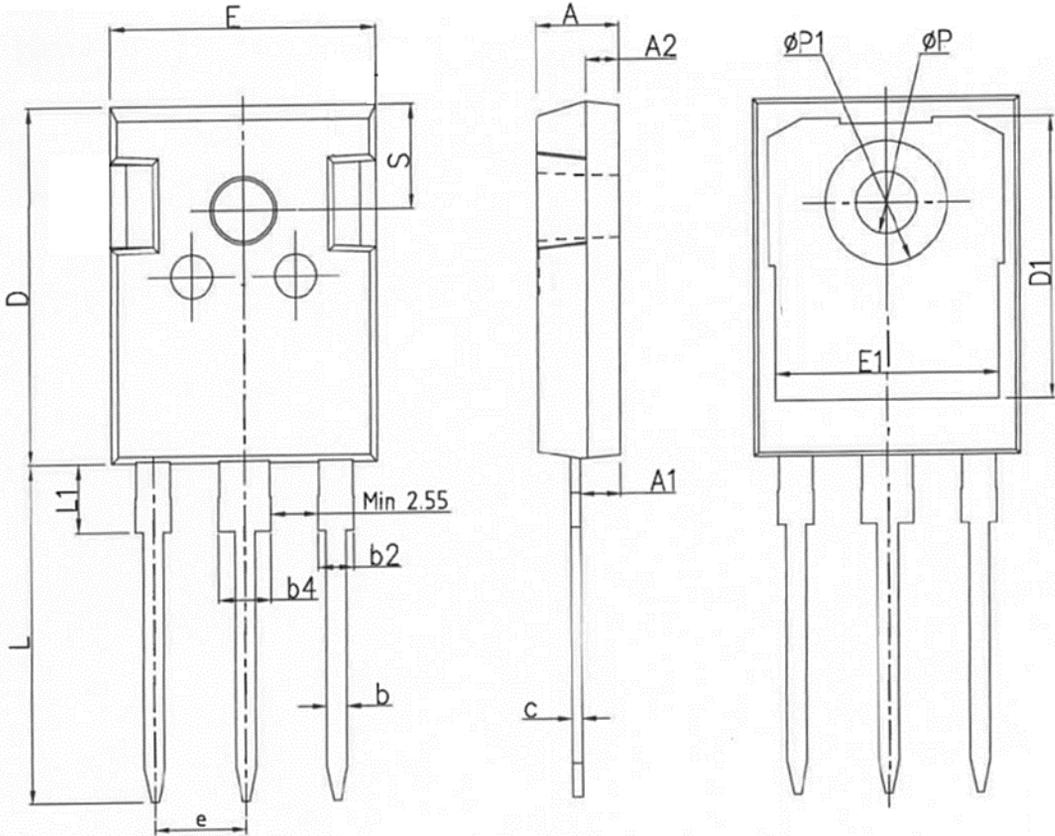
Test circuit and waveform for diode characteristics

Test circuit for diode characteristics



Diode recovery waveform





COMMON DIMENSIONS

SYMBOL	UNIT(mm)		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.20	2.40	2.60
A2	1.85	2.00	2.15
b	1.10	1.20	1.35
b2	1.91	2.04	2.21
b4	2.91	3.04	3.21
c	0.50	0.60	0.75
D	20.70	21.00	21.30
D1	16.20	16.55	16.90
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
e	5.44BSC		
L	19.60	19.95	20.30
L1	-	-	4.30
ΦP	3.40	3.60	3.80
ΦP1	-	-	7.50
S	6.15BSC		



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